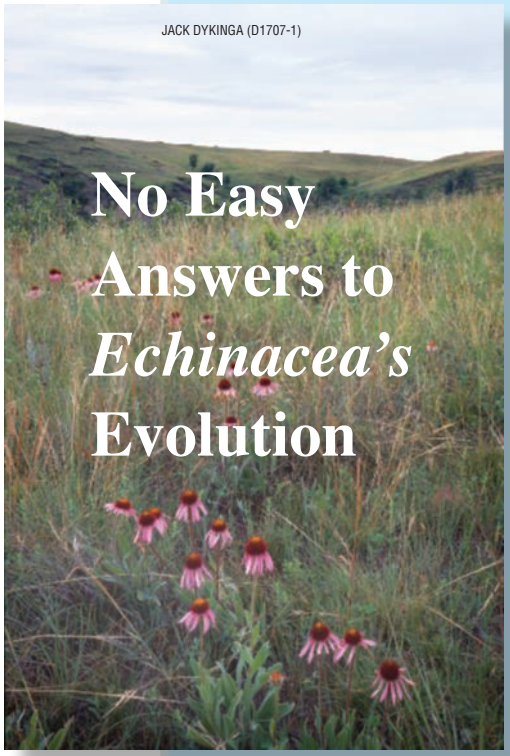
No Easy Answers to *Echinacea's* Evolution



Purple coneflower *(Echinacea).*

Every summer, gardens across the United States are visited by goldfinches feasting on seeds produced by the popular perennial *Echinacea*. But birds aren't the only ones that profit from these pretty coneflowers. According to estimates by Nutrition Business Journal, U.S. consumers looking for botanical remedies spent $126 million on *Echinacea* products in 2007. These products may modulate the human immune system, but they are also being studied for related effects on infections, inflammation, and pain receptors.

Only a few *Echinacea* species—*E. purpurea, E. angustifolia,* and *E. pallida*—are currently cultivated as remedies, and plant breeders would like to know whether other types also possess commercially useful traits. But first they need to know how many distinct *Echinacea* species there are. Previous studies have put the number between four and nine species, depending on classification criteria.

Mark Widrlechner, a horticulturist at the ARS North Central Regional Plant Introduction Station (NCRPIS) in Ames, Iowa, has joined an effort to solve this puzzle. Working with a team in Jonathan Wendel's lab at Iowa State University, Widrlechner selected 40 diverse *Echinacea* populations for DNA analysis from the many populations conserved at the NCRPIS.

Most of these *Echinacea* populations were found to have a remarkable range of genetic diversity. This complicated efforts to explain how so much diversity among different species could have evolved from a common ancestor.

"What we had was really, really hard to sort out," Widrlechner admits.

But the team has been able to make some sense out of the genetic jumble. For instance, DNA analysis suggested that when much of North America was covered with glaciers, *Echinacea* found southern refuges on both sides of the Mississippi River. But when the glaciers receded after thousands of years, the groups came together as they moved northward and began to hybridize, which might have blurred previous genetic distinctions.

Since DNA analysis did not provide conclusive results, Lankun Wu, from Eve Syrkin Wurtele's lab at Iowa State, focused on analyzing the same populations for chemical differences in root metabolites. These metabolites, which are often essential for survival and propagation, can vary widely among species and may play roles in human-health effects.

Using this approach, researchers were able to identify clear distinctions among all 40 populations. These distinctions were organized into three composite profiles that accounted for almost 95 percent of the metabolite variation among the populations.

Additional analysis indicated that the populations grouped together in ways that aligned well with earlier *Echinacea* species assignments that were based on plant morphology, supporting nine rather than only four distinct species. But Widrlechner says the research isn't close to a payoff for commercial producers—yet.

"Even though the metabolite study has given us some good species definitions, we still need to follow up with more genetic studies," Widrlechner says. "It's important to find the traits that may be medicinally beneficial."—By **Ann Perry,** ARS.

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